US Army Research Laboratory

Imagery from ARL Laser Radar Experiments

Presented by:

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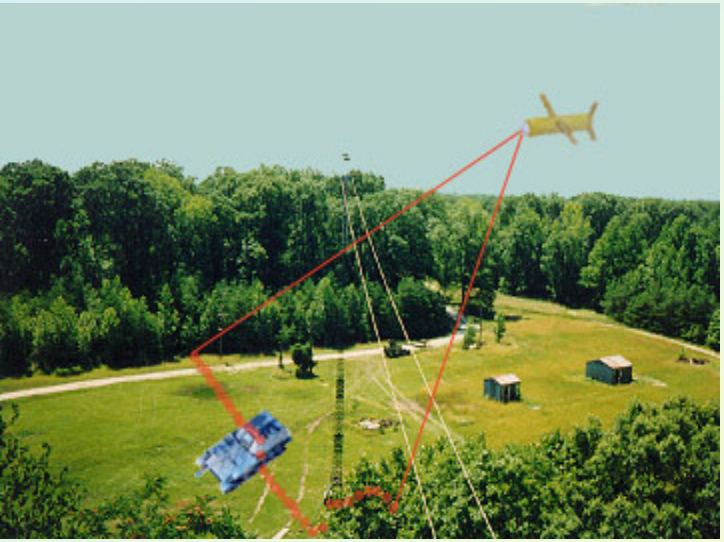
Outline

- How a Laser Radar (Ladar) works
- ARL FM/cw Ladar
- Imagery from 3 experiments
  - *Face recognition*
  - *Targets under camouflage nets*
  - *Targets under heavy foliage*

ARL FM/cw Ladar Program

Purpose

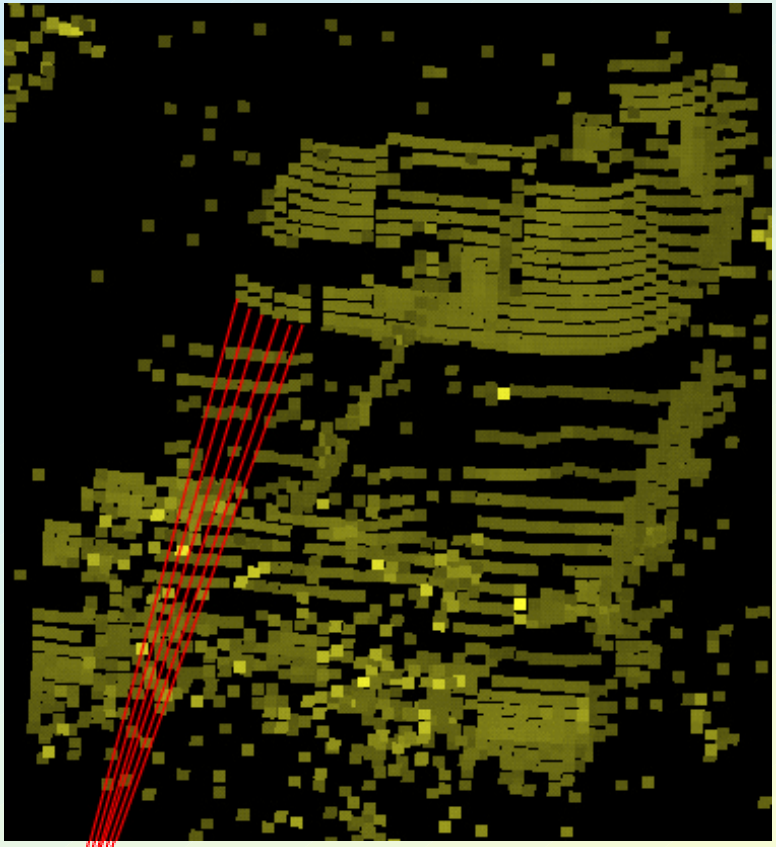
- Develop small, low-cost, eye-safe 3-D imaging system based on commercial technology
- Conduct data collections and develop visualization techniques



Impact

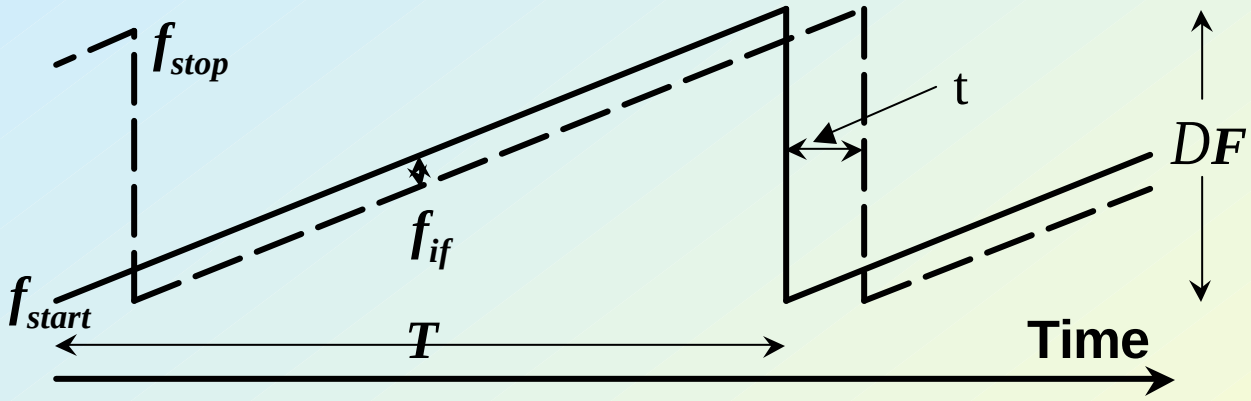
- Fopen results led into DARPA Jigsaw program
- Applications in munitions, air & ground autonomous sensors, and robotic visualization

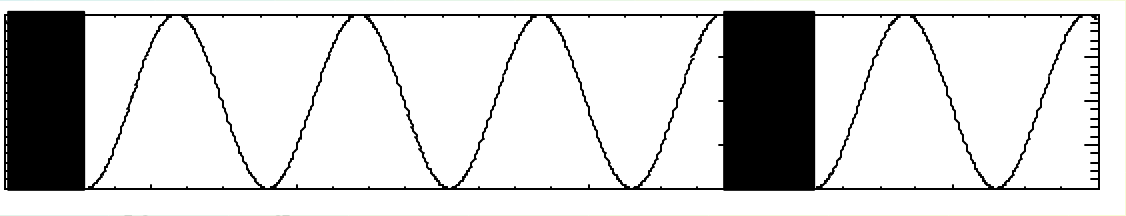
How a Laser Radar Works



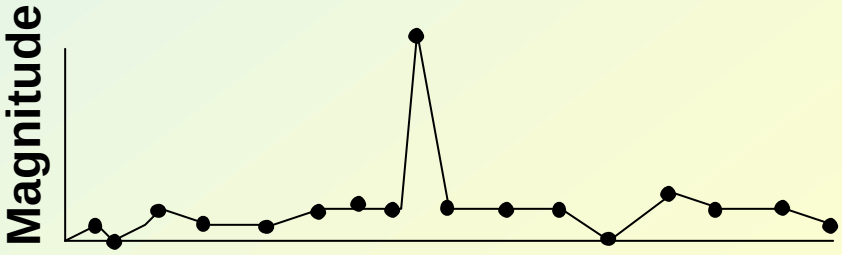
Laser beam

FM/cw Ladar Concept





$\cos(f_{if}\, t + f)$



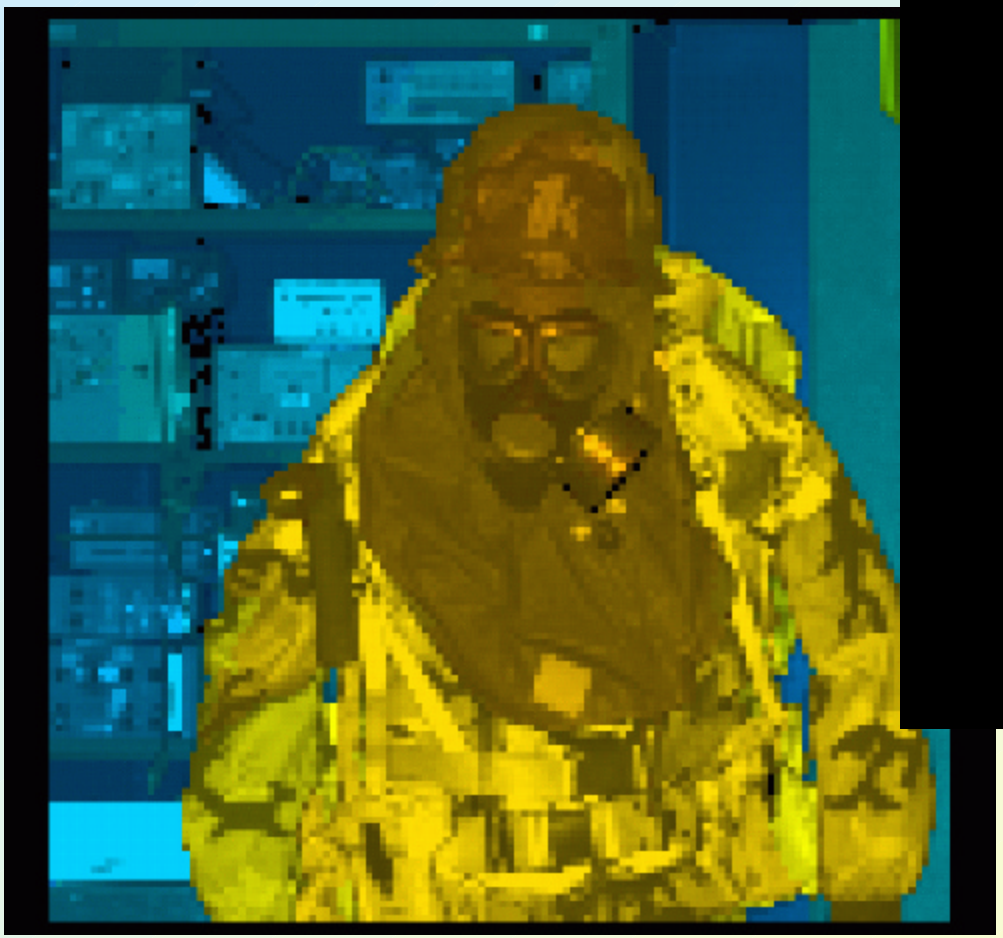
$\Delta R = c/2\Delta f$

Advantages of FM/cw Ladar

- **Low cost**
  - *Semiconductor laser*
  - *Low-frequency electronics*
- **High range accuracy**
  - *1 to 2 cm*
- **Multiple range hits per location**
  - *Hits on net or foliage and also on target*
  - *25 cm resolution*

Face Recognition

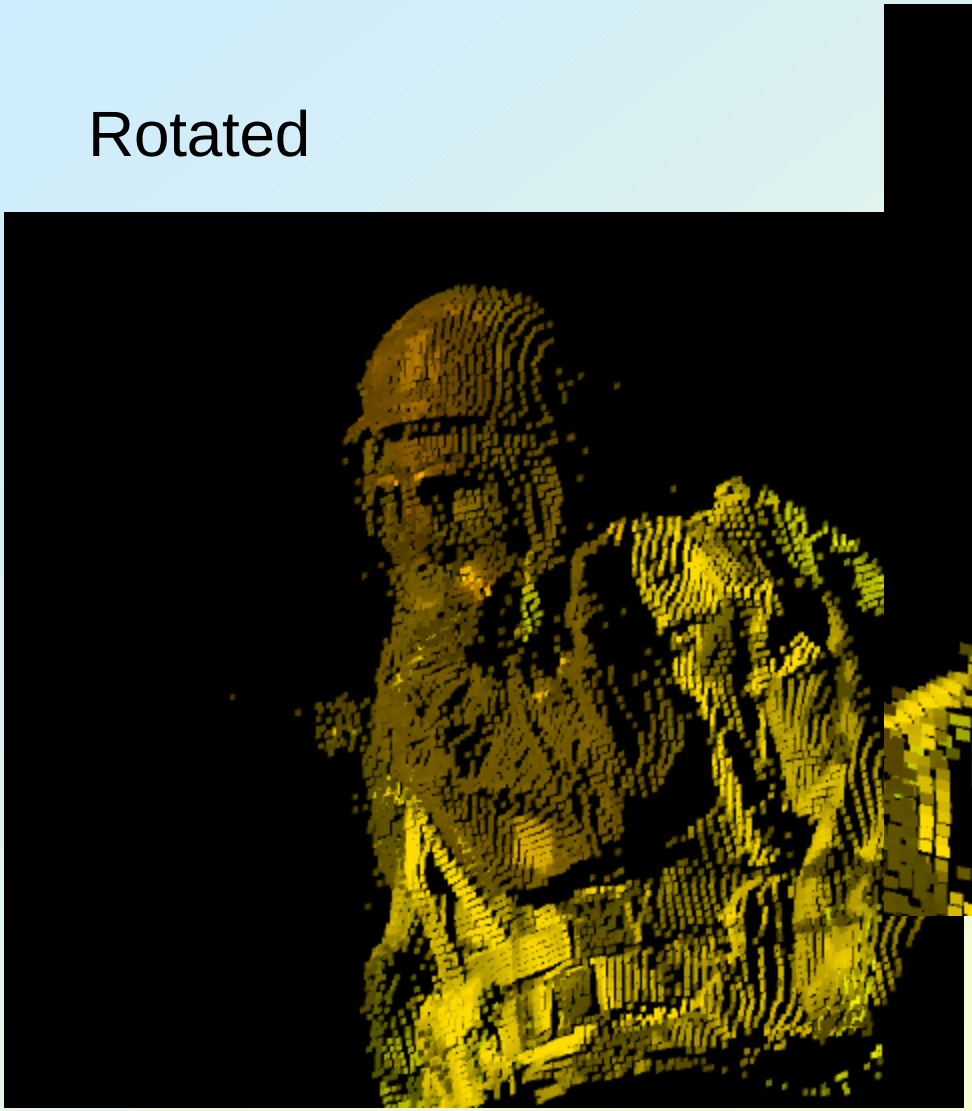
Mannequin, original perspective



Background gated out

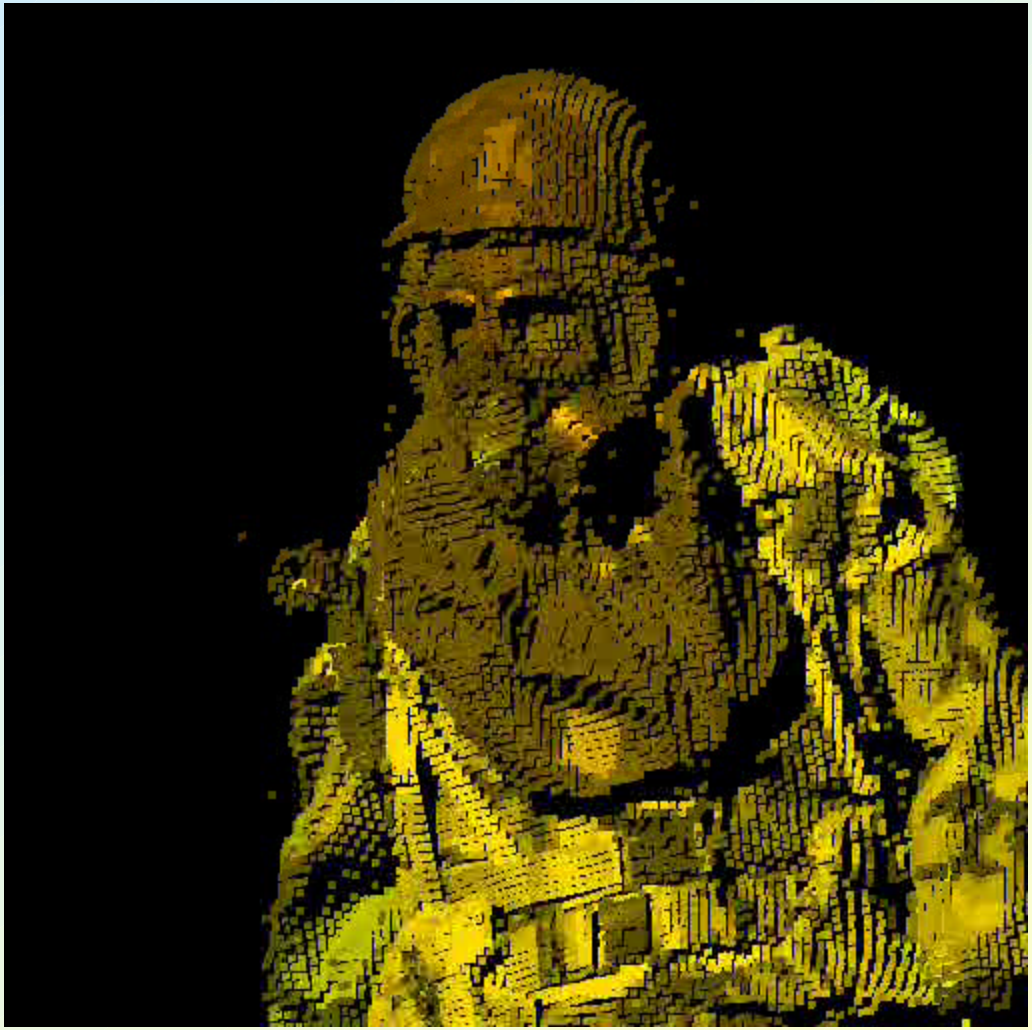
Face Recognition

Rotated



Zoomed

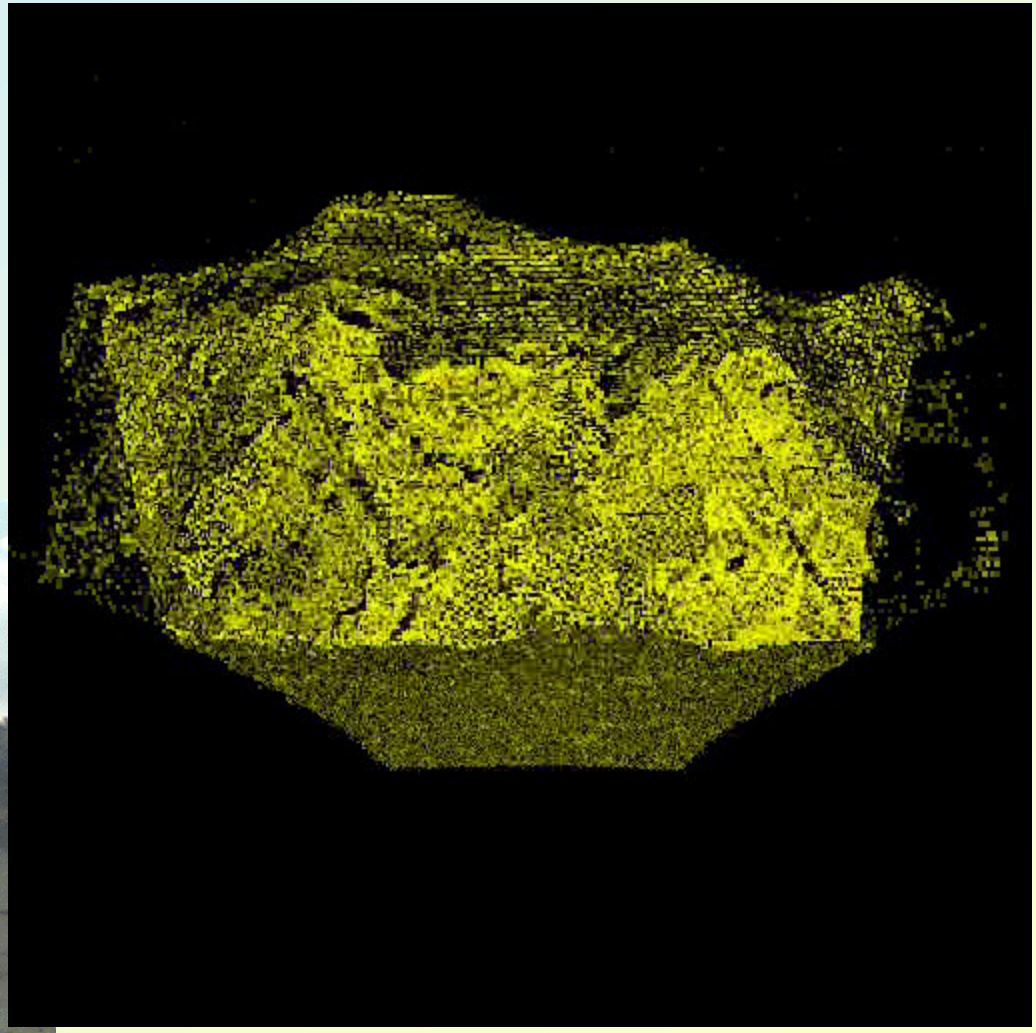
Face Recognition



Ladar movie

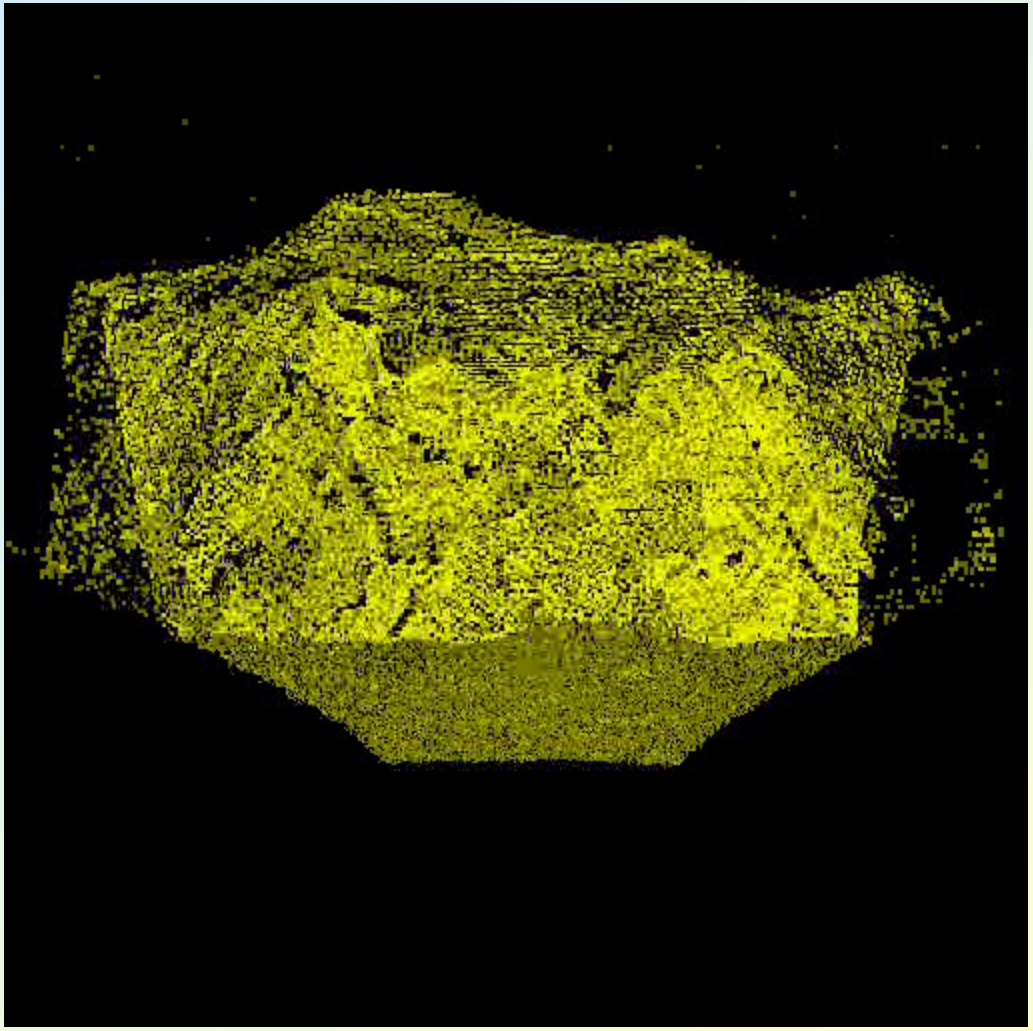
Targets Under Camo Nets

Photo



Ladar Movie

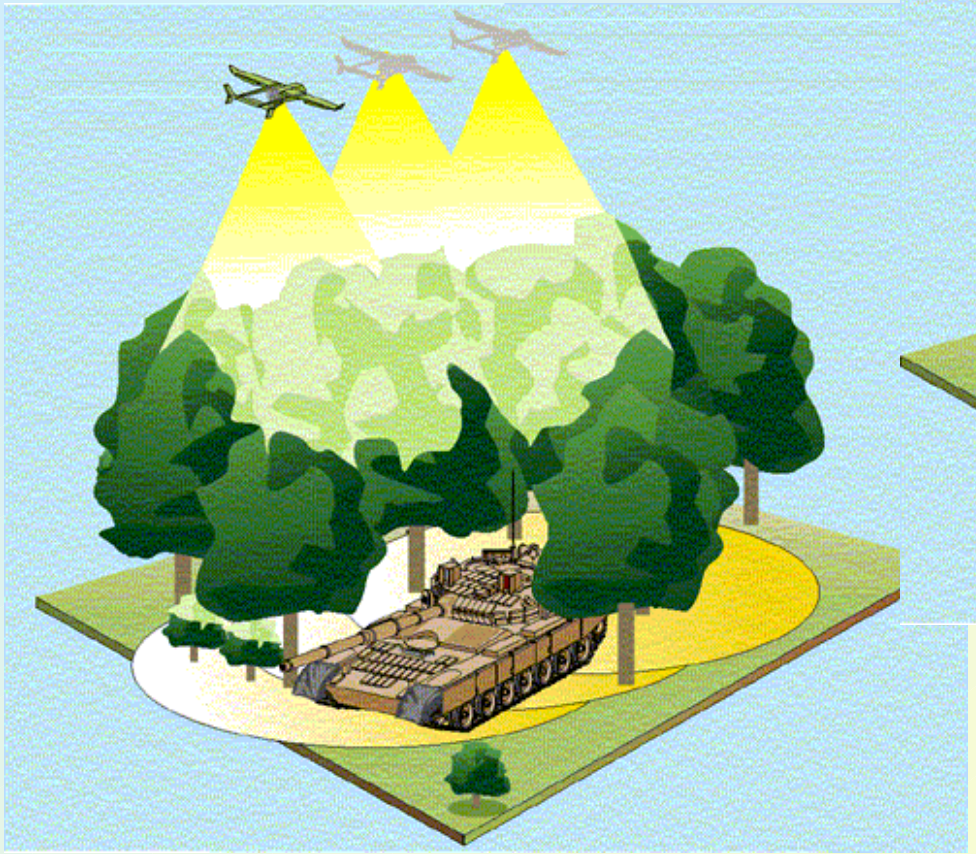
Targets Under Camo Nets

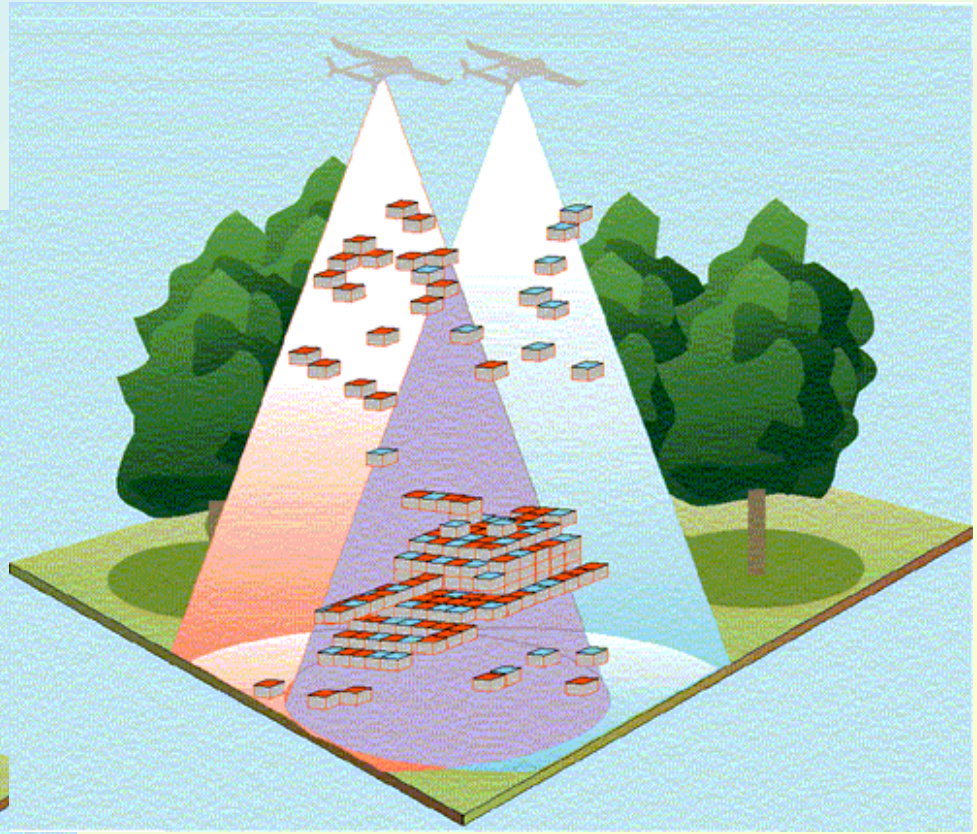


Ladar Movie

Fopen Concept

Multiple looks



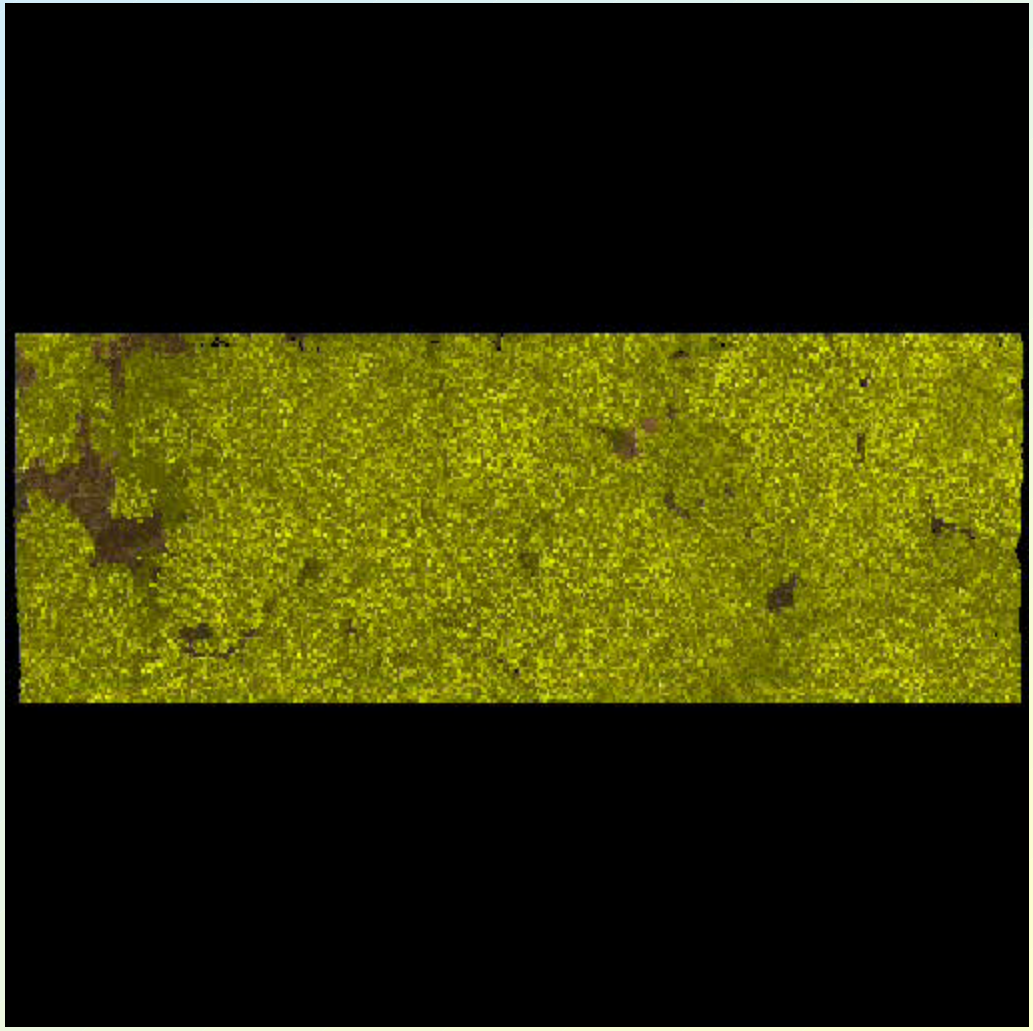


Scene construction

Fopen Field Experiment

MRL-240 Surrogate

Fopen Data Movie, Rotation



Ladar Movie

Fopen Data Movie, Zoom

Ladar movie

Conclusions

- **Ladar is an excellent sensor for difficult targets**
  - ***Hidden under nets***
  - ***Hidden in foliage***
- **Results ideal for human interpretation**
  - ***3-D stereo display crucial for complex scenes***
- **ARL FM/cw design has potential**
  - ***At short ranges, high quality for low cost***
  - ***Munitions, air and ground based sensors, and robotic applications***